

### Appendix F.5 Subsidence (Land Loss)

#### Vulnerability Assessment Parameters, Methodology and Results

The subsidence (land loss) hazard vulnerability assessment of State-owned buildings and critical facilities in Louisiana involved an analysis of land loss studies such as the *Coast 2050* report prepared by the Louisiana Coastal Wetlands Conservation and Preservation Task Force. The results of these subsidence (land loss) studies were then used to prepare subsidence (land loss) zones based on average subsidence (land loss) rates in one of four basins covering southern Louisiana.

Based on this information, a hazard vulnerability assessment level (low, medium or high) was assigned for each of the State-owned buildings and critical facilities. The three hazard vulnerability levels are defined below.

- Low Hazard Vulnerability: Structures located outside the four basins with projected subsidence (land loss) rates.
- Medium Hazard Vulnerability: Structures located in the two basins with the lowest projected subsidence (land loss) rates.
- High Hazard Vulnerability: Structures located in the two basins with the highest projected subsidence (land loss) rates.

Map 4-10, Hazard Profile – Subsidence (Land Loss), shows the subsidence (land loss) hazard zones and the extent of potential land loss areas throughout the State of Louisiana. Map F-79 indicates the location of State-owned critical facilities in Louisiana in relation to the subsidence (land loss) hazard zones.

Map F-80 shows State-owned critical facilities by level of vulnerability to the subsidence (land loss) hazard.

#### Loss Estimate Parameters and Methodology

The loss estimate due to subsidence (land loss) for State-owned buildings and critical facilities in Louisiana involved an analysis of the parameters described below.

- Subsidence (Land Loss) Hazard Vulnerability: As stated above, subsidence (land loss) hazard vulnerability assessments involved an analysis of subsidence (land loss) studies such as the *Coast 2050* report prepared by the Louisiana Coastal Wetlands Conservation and Preservation Task Force. Low, medium, and high vulnerability for subsidence is defined above.
- Average Subsidence (Land Loss) Rates: Although the subsidence (land loss) rates were available from the *Coast 2050* report analysis results, the actual subsidence / land losses for individual State-owned buildings and critical facilities could not be estimated due to the lack of available site-specific data for each structure. Therefore, average subsidence (land loss) rates for individual structures were estimated over a 100-year time period based on their corresponding subsidence (land loss) hazard vulnerability level. These basic surge inundation depths are defined below.
  - For low hazard vulnerability structures, no land loss rate was used since the structures were located outside the subsidence (land loss) hazard zone.
  - For medium hazard vulnerability structures, an average elevation reduction of 1 to 3 feet was estimated to account for the average subsidence (land loss) rate within the medium subsidence (land loss) hazard zone over a 100-year period.

## Appendix F – Risk Assessment for State-Owned Assets (continued)

- For high hazard vulnerability structures, an average elevation reduction of 4 to 6 feet was estimated to account for the average subsidence (land loss) rate within the high subsidence (land loss) hazard zone over a 100-year period.
- Average Building Type: Although the building types for each structure were described in the statewide GIS database, an analysis of all building types for individual State-owned buildings and critical facilities was beyond the scope of this loss estimate. Therefore, in order to conduct basic analyses, individual loss estimates assumed an average building type of a single story structure without a basement. This average building type was determined based on experience with typical buildings and foundation construction techniques in Louisiana.
- Land Loss Damage Functions (LLDFs): Physical (building) damage, contents damage and LOF costs for each structure were estimated based on a series of LLDFs. These LLDFs were based on qualitative estimates of structural damage due to land loss over a period of 100 years. The LLDFs for building damage, contents damage and LOF days used for the land loss estimates are summarized in the Table F.5-1.

Table F.5-1

Land Loss Hazard Vulnerability Level	Average Building Type	Average Land Loss Rate (elevation in feet/century)	Building LLDF (%BRV)	Contents LLDF (%BRV)	LOF (days)
Low	1 Story without Basement	None	0.0%	0.0%	0
Medium	1 Story without Basement	1 - 3 feet	50.0%	0.0%	0
High	1 Story without Basement	4 - 6 feet	100.0%	0.0%	30

NOTES: 1.) FFE = First Floor Elevation

2.) Assume average FFE is approximately 4 feet above sea level.

3.) Assume building LLDF values based on the following formulas:

For Medium Hazard Vulnerability Level - assume building has suffered some structural damage due to land loss rate below the FFE.

For High Hazard Vulnerability Level - assume building has suffered severe or structural damage or damage or is surrounded by water and must be abandoned due to land loss rate above FFE.

4.) Assume zero contents damages from land loss.

- Physical Damage: Physical damages were estimated as a percentage of the BRV. For each structure, the BRV was determined based on building values obtained from the statewide GIS database. The physical damage costs were computed by multiplying the BRV by the corresponding building LLDF.
- Contents Damage: Contents damages were estimated to be zero for all subsidence (land loss) hazard vulnerability levels in Louisiana.
- LOF: LOF costs were estimated as a proportion of the annual operating budget for each structure. The annual operating budgets for each facility were determined as a proportion of the current annual operating budget for the State of Louisiana. This annual operating budget, currently estimated at approximately \$16.0 billion, was distributed to individual State-owned buildings and critical facilities based on the *factored square footage* of each structure. The factored square footage for each structure was determined by multiplying the actual square footage by a CF based on the criticality of each structure. A summary of CFs for all structures in Louisiana is provided in Table F.1-2. Note that by applying the CF to the square footage of each structure, it allows higher criticality facilities (such as fire stations) to obtain a larger proportion of the statewide annual budget, thereby increasing their annual budget values and LOF costs to reflect their importance. Once the annual operating budget was obtained for each structure, the LOF costs were computed by dividing the annual operating budget

## Appendix F – Risk Assessment for State-Owned Assets (continued)

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by 365 (to convert the annual budget to a daily budget) and multiplying by the corresponding LLDF for LOF (measured in days).

Once these parameters were determined, the combined loss estimate (building, contents, and LOF) in dollars for each structure was determined using the following formula:

$$\text{Combined Loss Estimate} = (\text{Physical Damage} + \text{LOF})$$

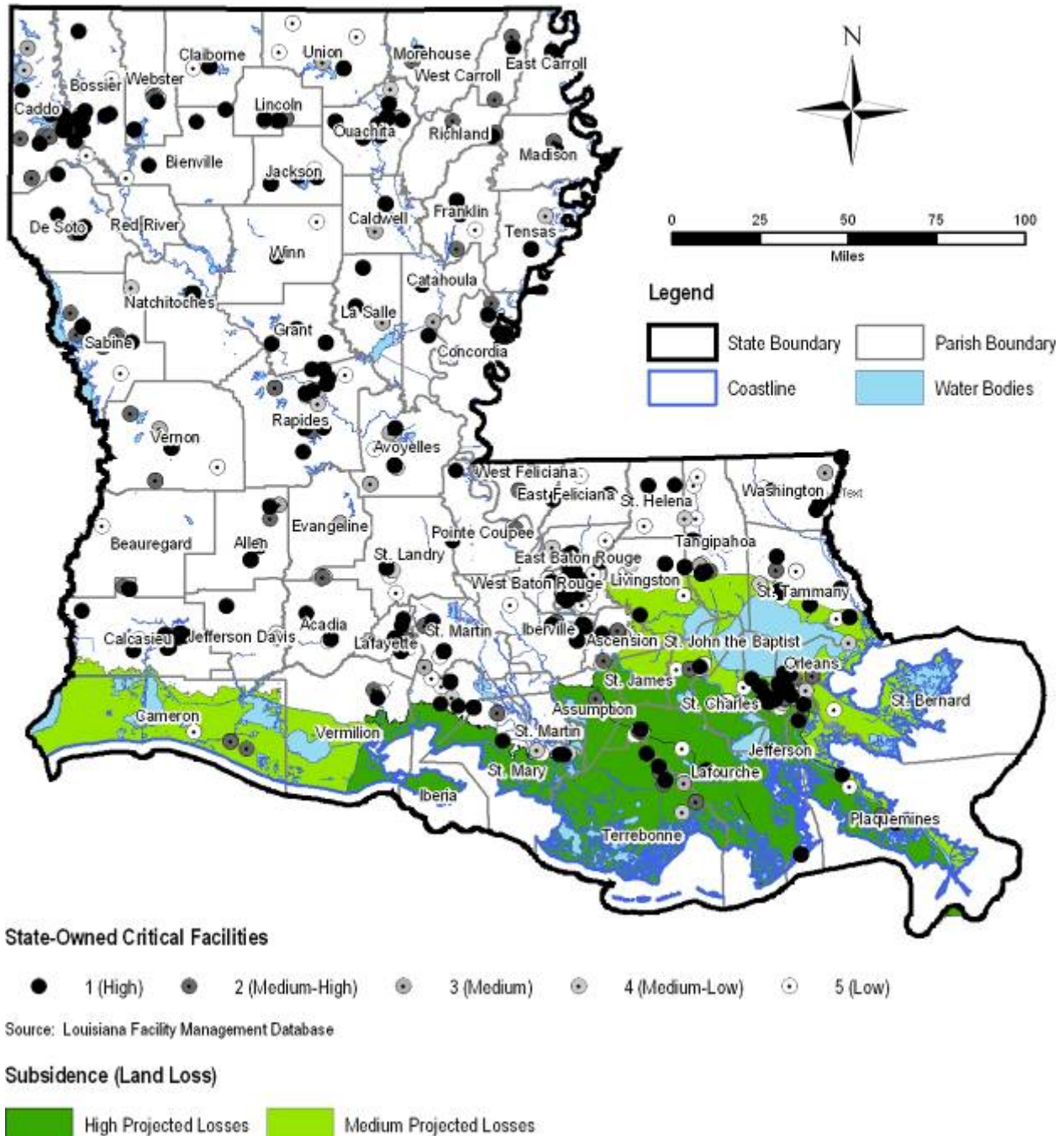
The critical facilities in Louisiana with highest physical damage and LOF costs for land loss are presented in Maps F-81 and F-82 respectively. Map F-83 (also Map 6-8) provides the results of the combined loss estimate computations for the subsidence (land loss) hazard. The ten critical facilities in Louisiana with the highest combined loss estimates for the subsidence (land loss) hazard are shown on Map F-84 (also Map 6-8) and are summarized in Table 6-18. State-owned critical facilities for each agency in Louisiana with the highest combined loss estimates for the subsidence (land loss) hazard are presented in Maps F-85 thru F-93.

### List of Assumptions

The loss estimate for land loss is based on the following assumptions.

- General: Loss estimates for individual structures due to subsidence (land loss) are based on the estimates taken from the available subsidence (land loss) analysis results. Note that the assigning of numerical values and factors for loss estimate parameters is often qualitative in nature and based on data from a number of sources with varying degrees of accuracy. For this reason, loss estimates for individual structures due to subsidence (land loss) should not be used for estimating general property insurance coverage or other needs that require a high degree of accuracy.
- Subsidence (Land Loss) Hazard Vulnerability and Average Subsidence (Land Loss): No subsidence (land loss) effects are experienced by structures constructed outside the four land loss basins designated for southern Louisiana. Subsidence (land loss) effects equivalent to a first floor elevation drop of 1 to 3 feet are experienced by structures in the land loss basins with the two lowest projected land loss rates. Subsidence (land loss) effects equivalent to a first floor elevation drop of 4 to 6 feet are experienced by structures in the subsidence (land loss) basins with the two highest projected subsidence (land loss) rates.
- Average Building Type and LLDFs: The physical and contents damages to individual State-owned buildings and critical facilities from land loss will be considered the same as a single story structure without a basement (i.e., slab-on-grade) constructed using standard residential building materials.
- Physical Damage: For each structure, the BRV is consistent with the building values obtained from the statewide GIS database. In the event the statewide GIS database did not provide a BRV for an individual structure, the BRV was estimated to be zero.
- Contents Damage: For each structure, the contents replacement value is considered zero. Since subsidence (land loss) events occur gradually over a long period of time, the contents can be protected from damage by removing them before the land loss becomes an immediate threat to the structure.
- LOF: The \$16.0 billion current annual operating budget for the State of Louisiana is distributed among all State-owned buildings and critical facilities in the statewide GIS database based on the factored square footage of each structure. In the event the statewide GIS database did not provide a square footage and/or criticality level for an individual structure, that square footage and/or criticality level was estimated based on the average square footage and/or criticality level for all structures in the statewide GIS database with available data. The CFs were derived based loosely on FEMA's *What is a Benefit?* draft guidance document dated May 1, 2001 and engineering judgment. The LOF for structures that must be abandoned due to subsidence (land loss) is capped at 30 days to maintain consistency with loss estimates for other hazards such as flood and wind.

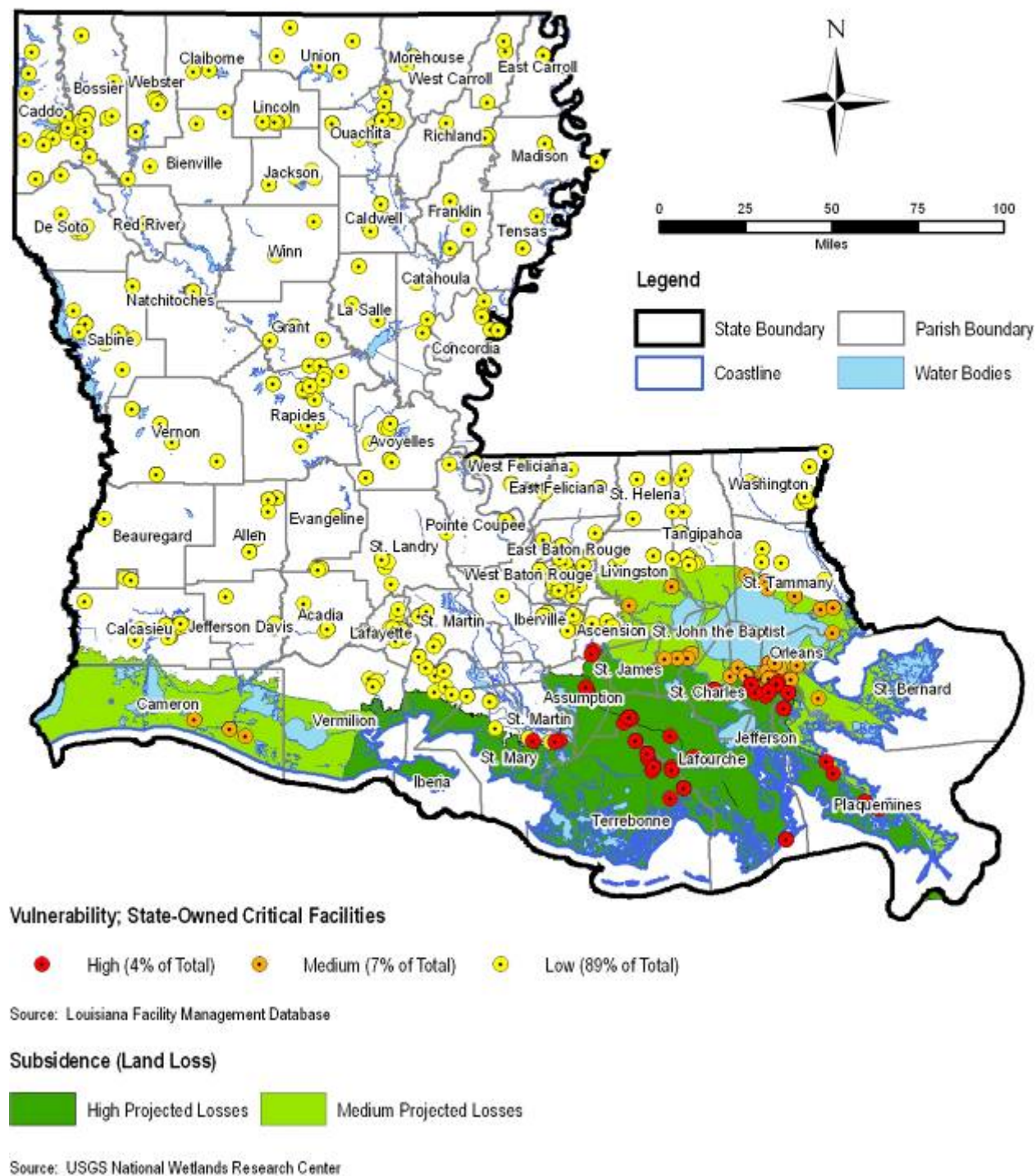
Map F-79: Location of Critical Facilities - Subsidence (Land Loss)



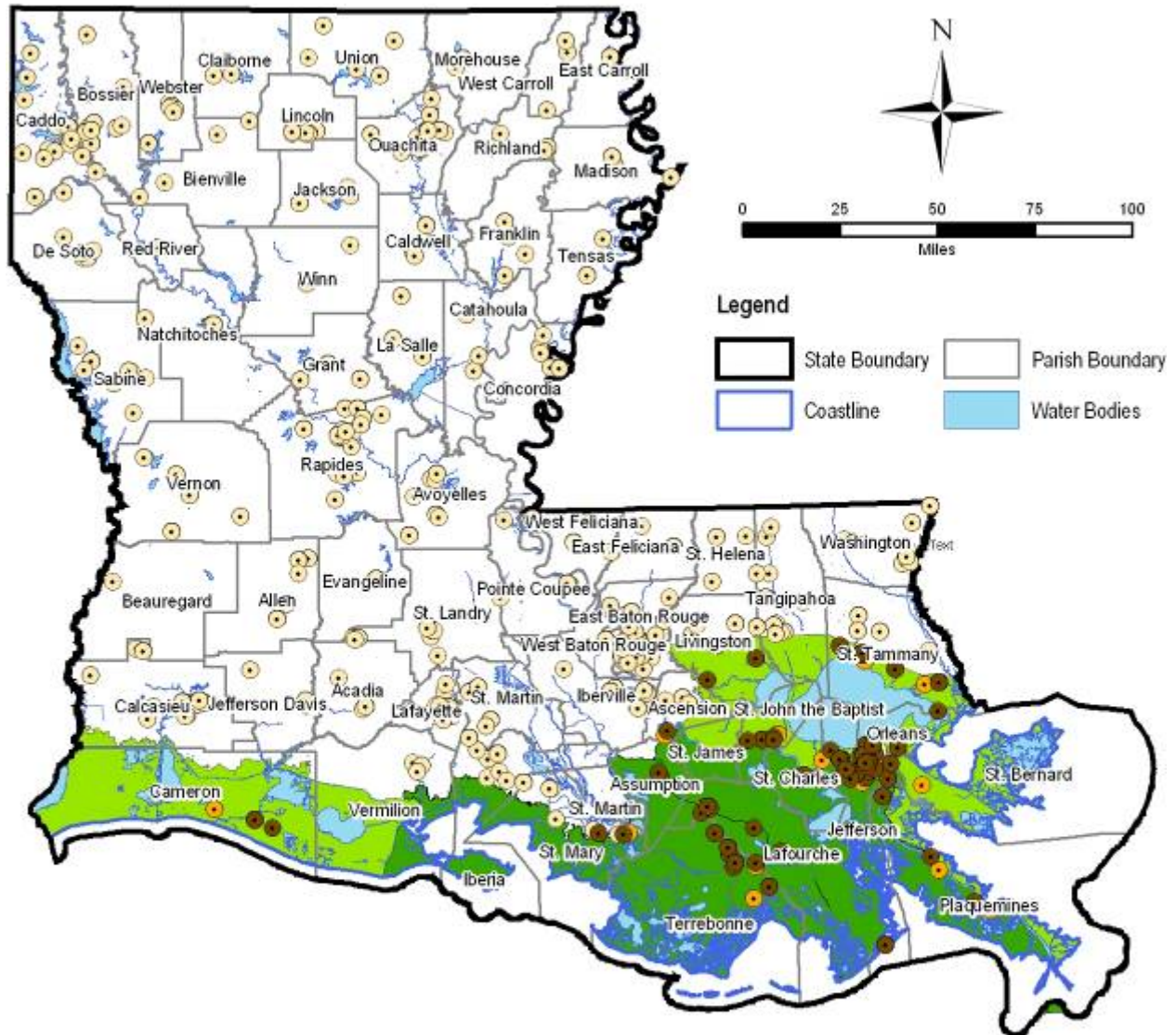
Source: USGS National Wetlands Research Center



Map F-80: Vulnerability Assessment - Subsidence (Land Loss)



Map F-81: Loss Estimate - Subsidence (Land Loss) - Physical Damage



**Estimated Losses**

Low: \$0 Medium: \$1 - \$20,000 High: \$20,001 - \$150,000,000

Source: Louisiana Facility Management Database

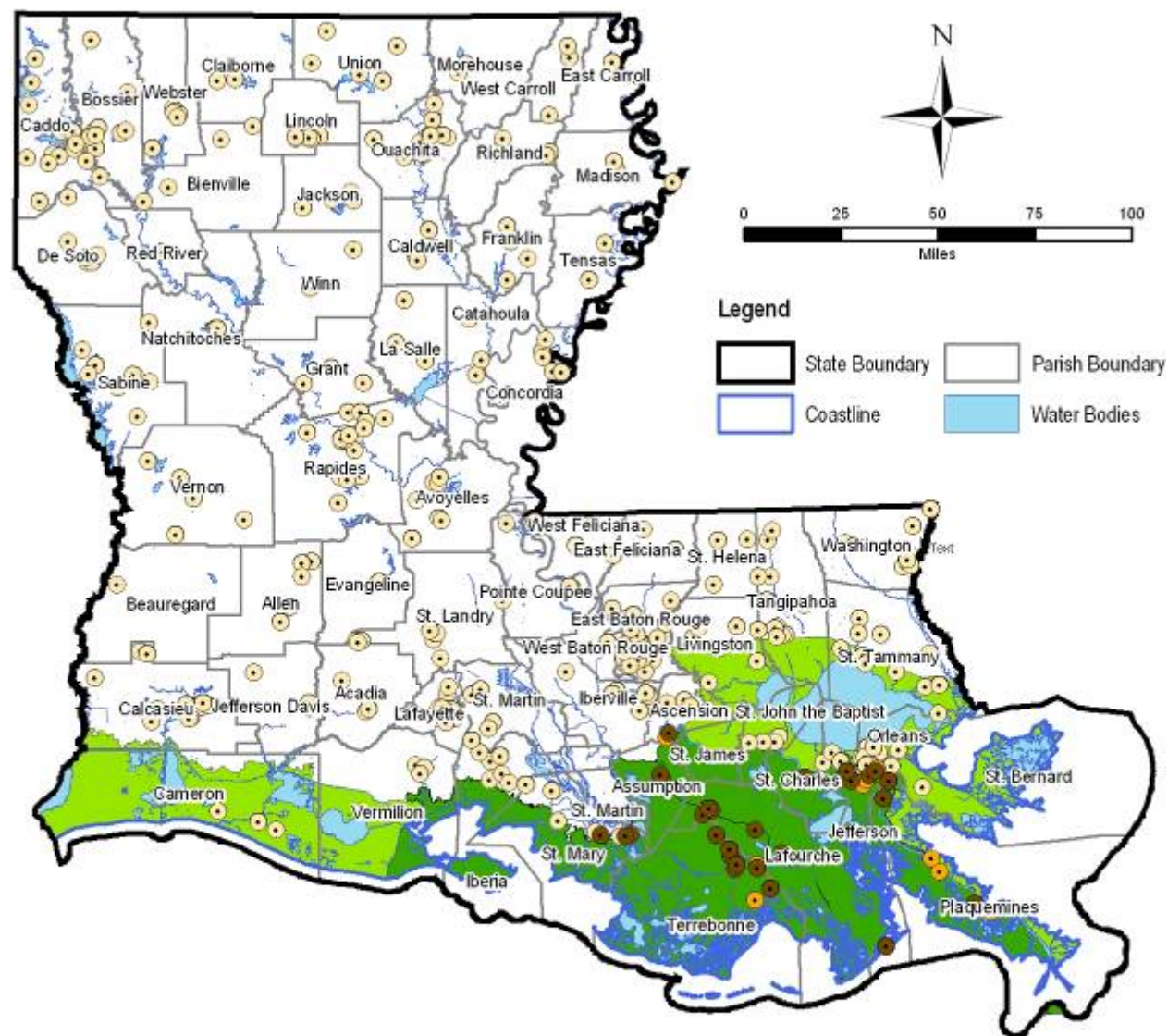
**Subsidence (Land Loss)**

High Projected Losses Medium Projected Losses

Source: USGS National Wetlands Research Center



Map F-82: Loss Estimate - Subsidence (Land Loss) - Function



**Estimated Losses**

- Low: \$0
- Medium: \$1 - \$15,000
- High: \$15,001 - \$10,000,000

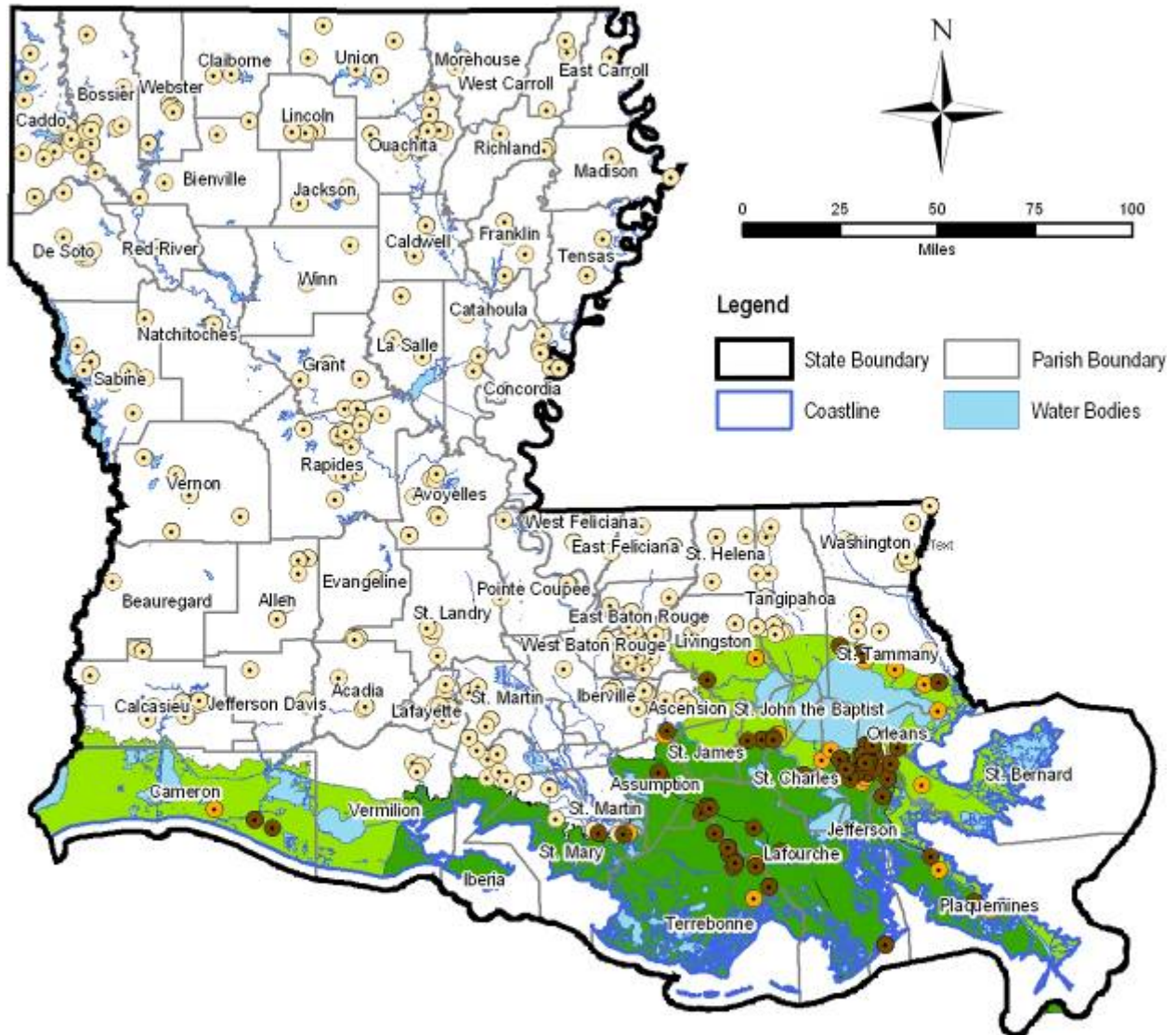
Source: Louisiana Facility Management Database

**Subsidence (Land Loss)**

- High Projected Losses
- Medium Projected Losses

Source: USGS National Wetlands Research Center

Map F-83: Loss Estimate - Subsidence (Land Loss) - Total



**Estimated Losses**

- Low: \$0
- Medium: \$1 - \$50,000
- High: \$50,001 - \$145,000,000

Source: Louisiana Facility Management Database

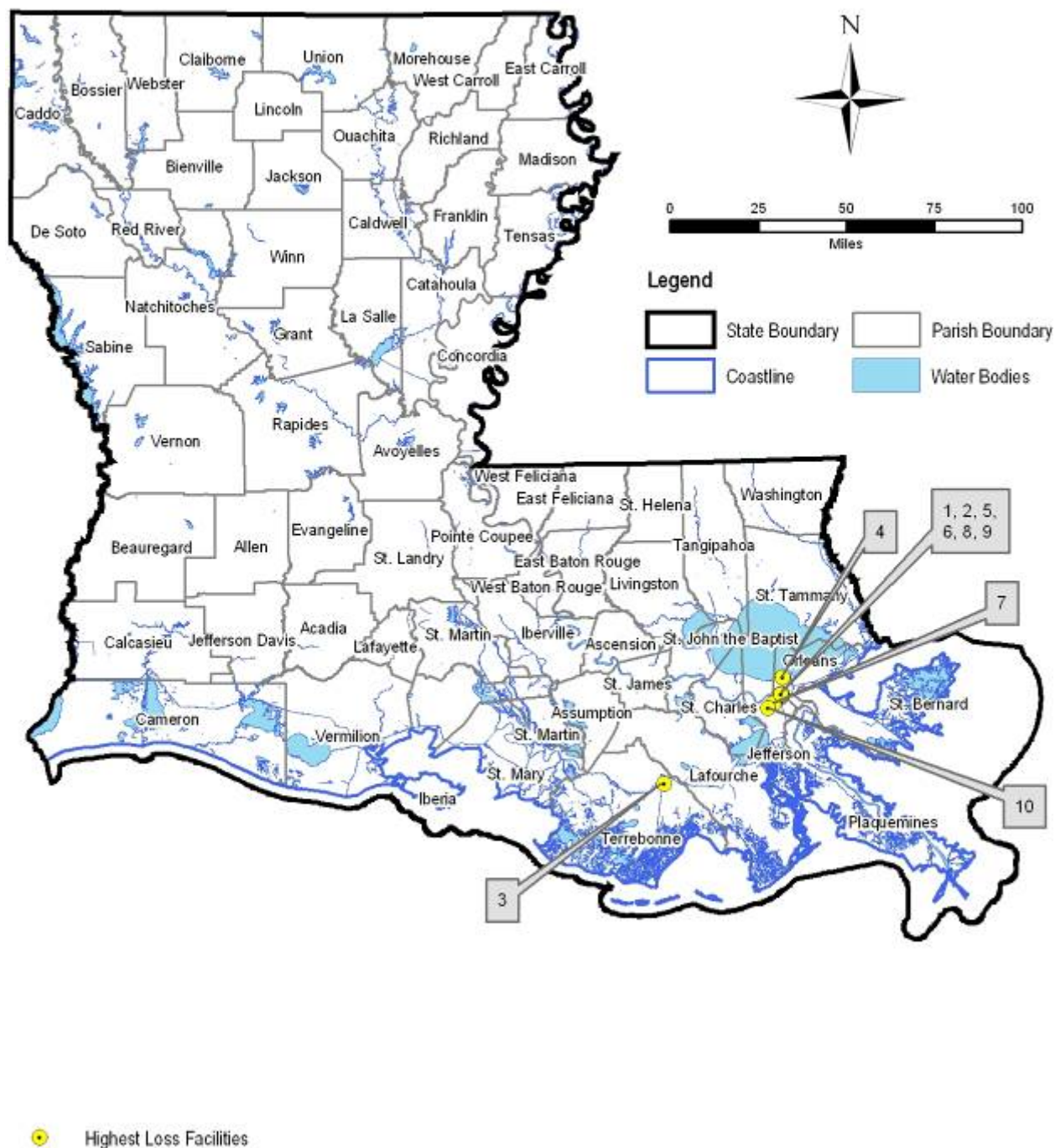
**Subsidence (Land Loss)**

- High Projected Losses
- Medium Projected Losses

Source: USGS National Wetlands Research Center

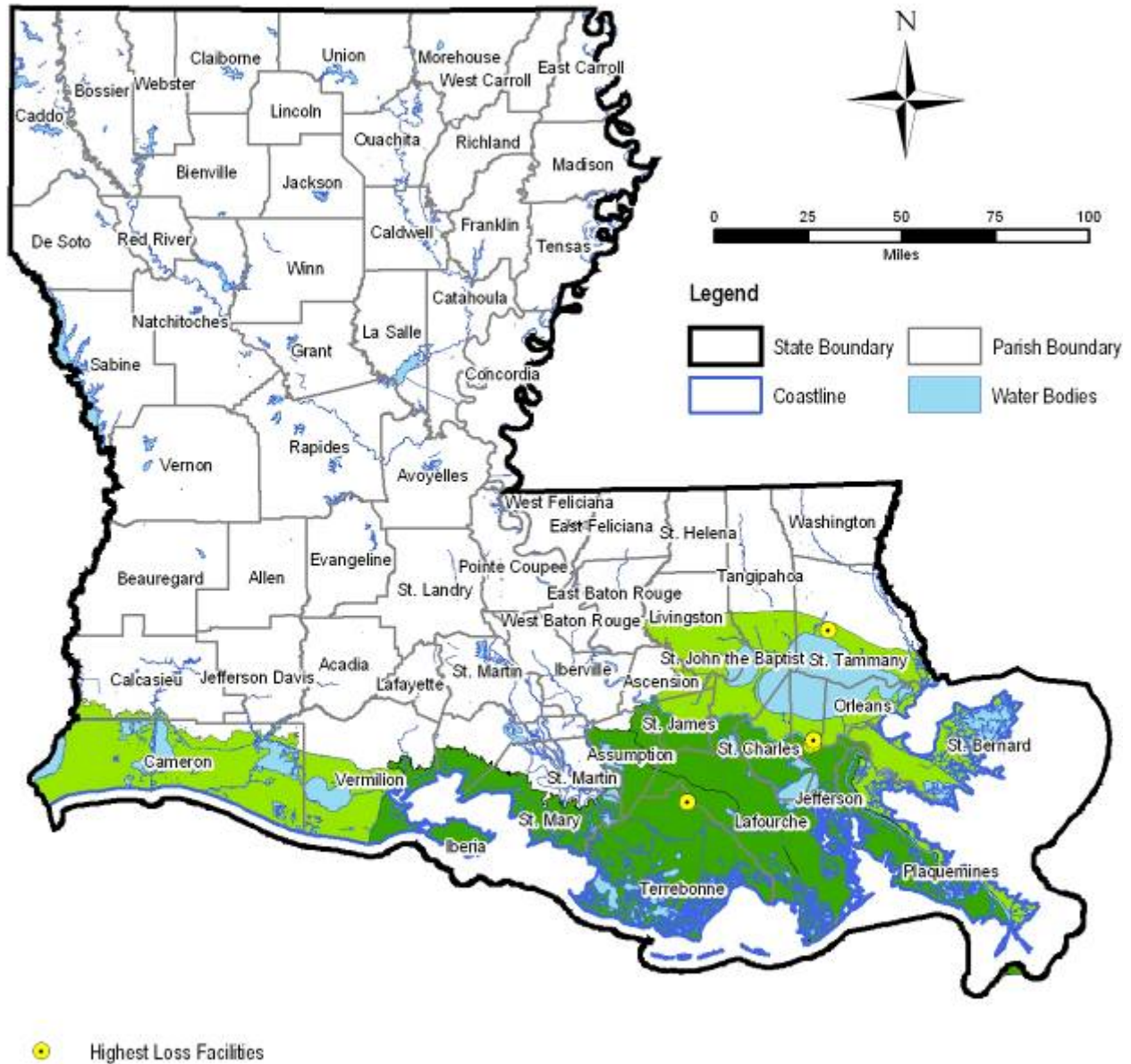


Map F-84: Loss Estimate - Subsidence (Land Loss) - Top Ten



Source: Louisiana Facility Management Database

**Map F-85: Loss Estimate - Subsidence (Land Loss) - Top 10 - Department of Public Safety and Corrections**



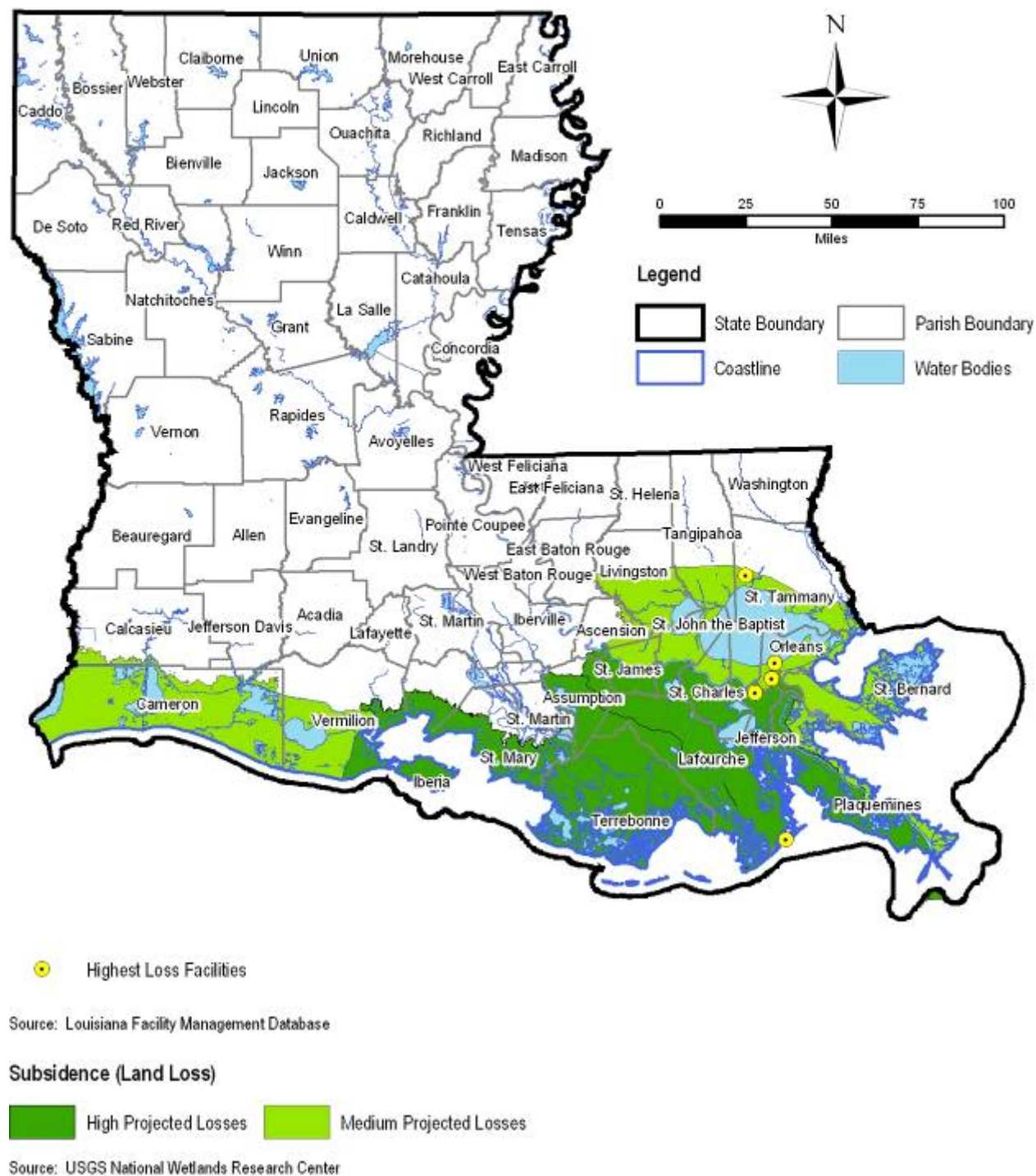
Source: Louisiana Facility Management Database

**Subsidence (Land Loss)**

High Projected Losses Medium Projected Losses

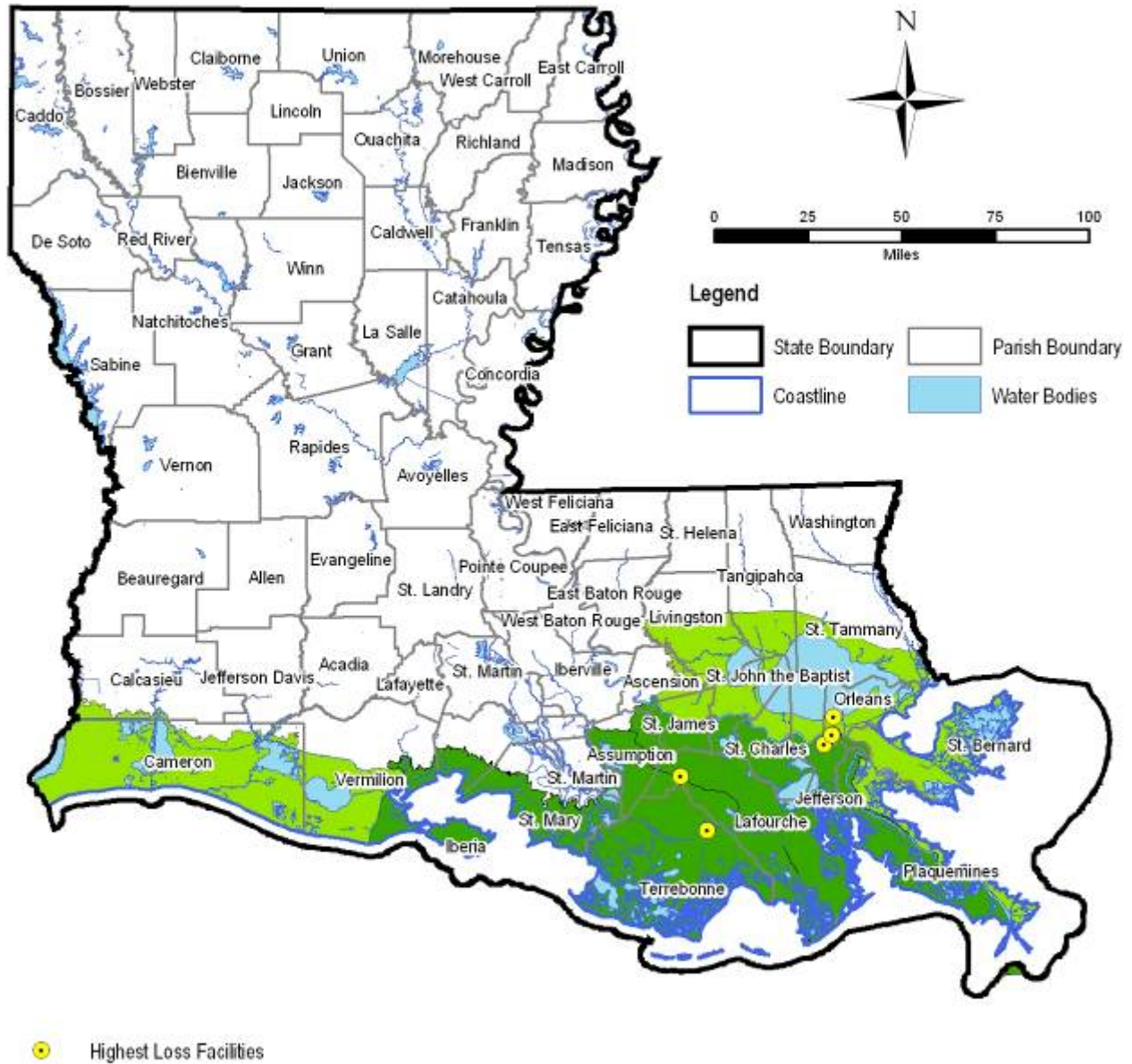
Source: USGS National Wetlands Research Center

**Map F-86: Loss Estimate - Subsidence (Land Loss) - Top 10 - Department of Culture, Recreation and Tourism**





Map F-87: Loss Estimate - Subsidence (Land Loss) - Top 10 - Department of Education



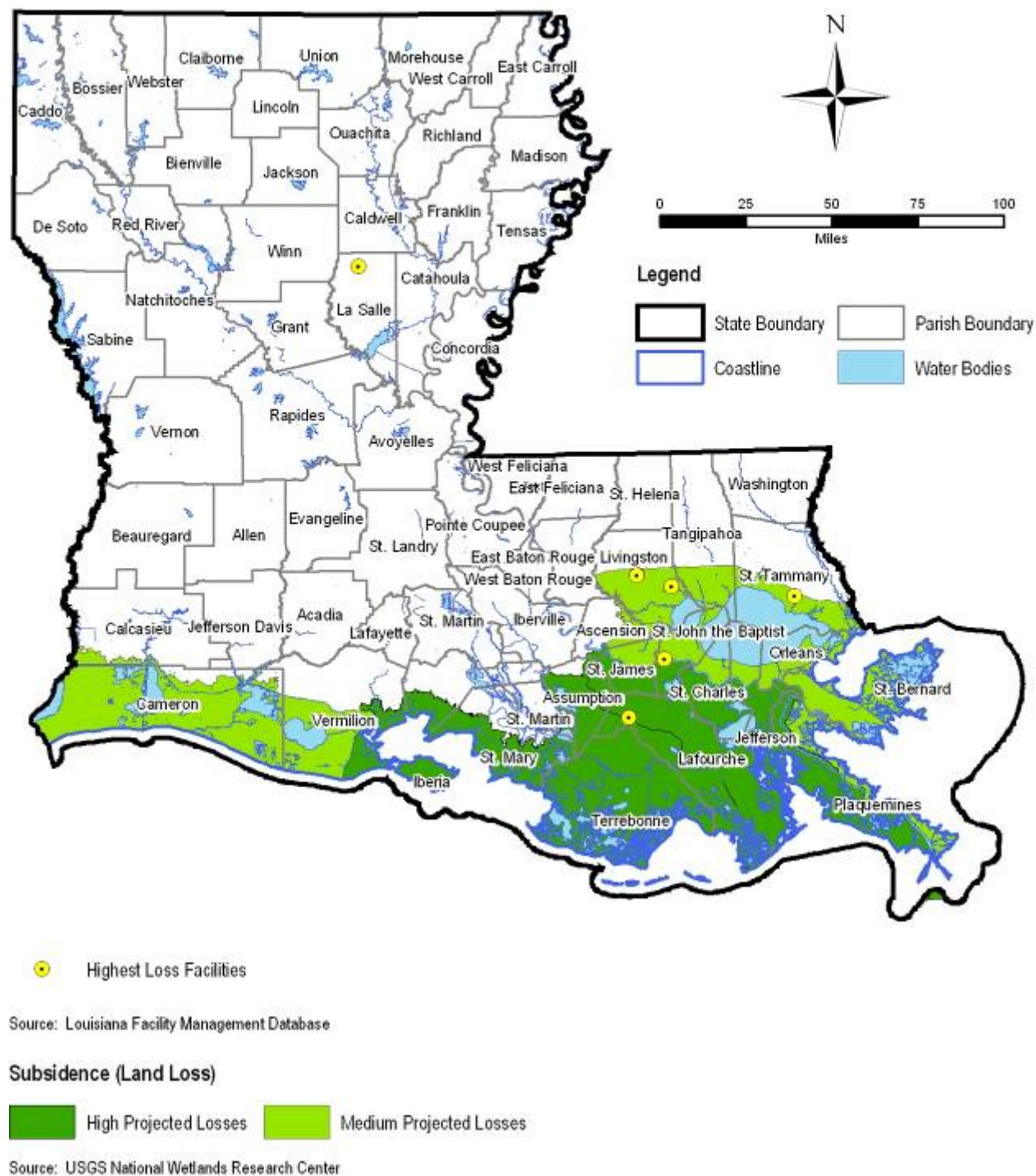
Source: Louisiana Facility Management Database

**Subsidence (Land Loss)**

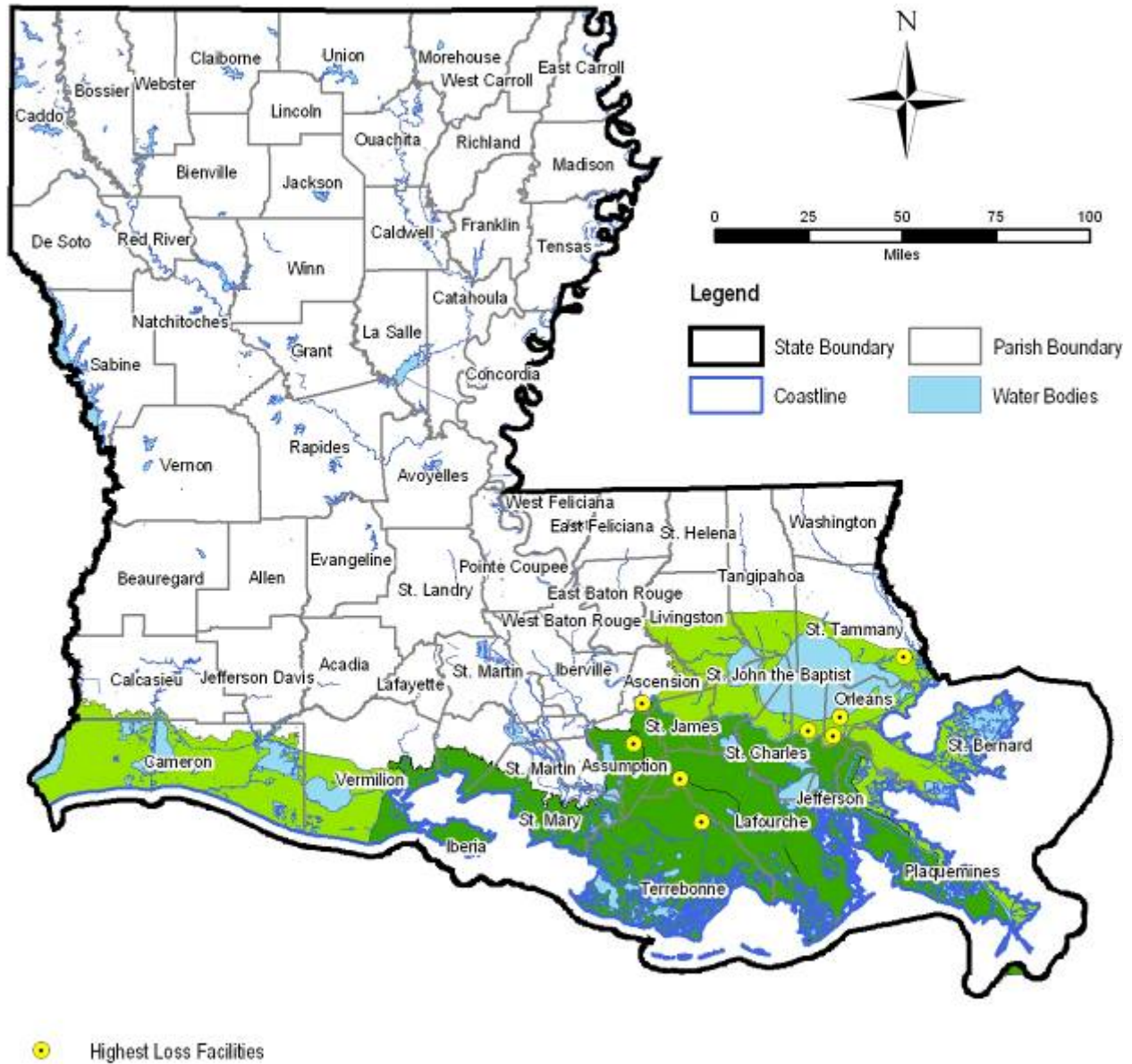
High Projected Losses Medium Projected Losses

Source: USGS National Wetlands Research Center

Map F-88: Loss Estimate - Subsidence (Land Loss) - Top 10 - Elected Officials



Map F-89: Loss Estimate - Subsidence (Land Loss) - Top 10 - Executive Department



Source: Louisiana Facility Management Database

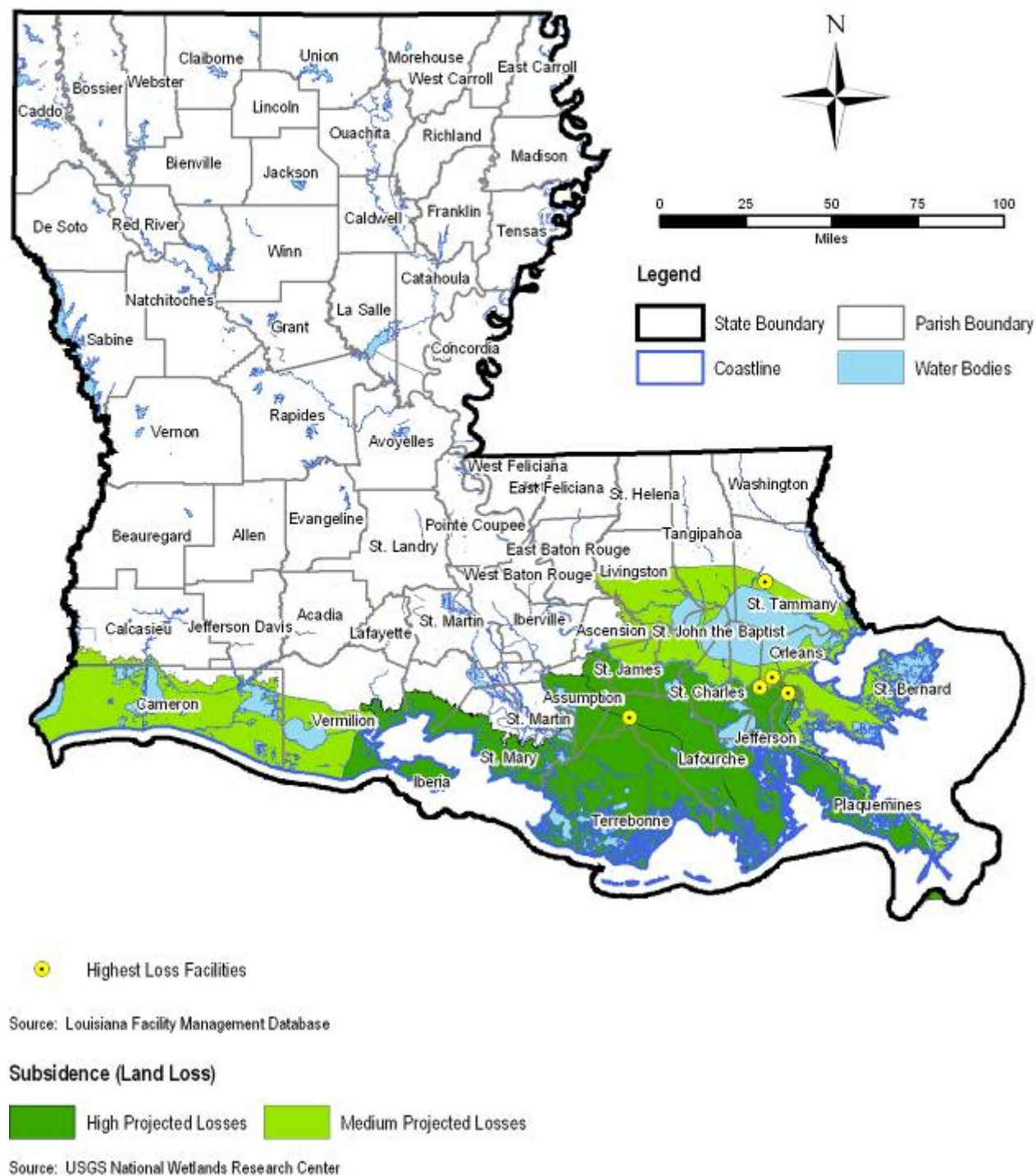
**Subsidence (Land Loss)**

High Projected Losses Medium Projected Losses

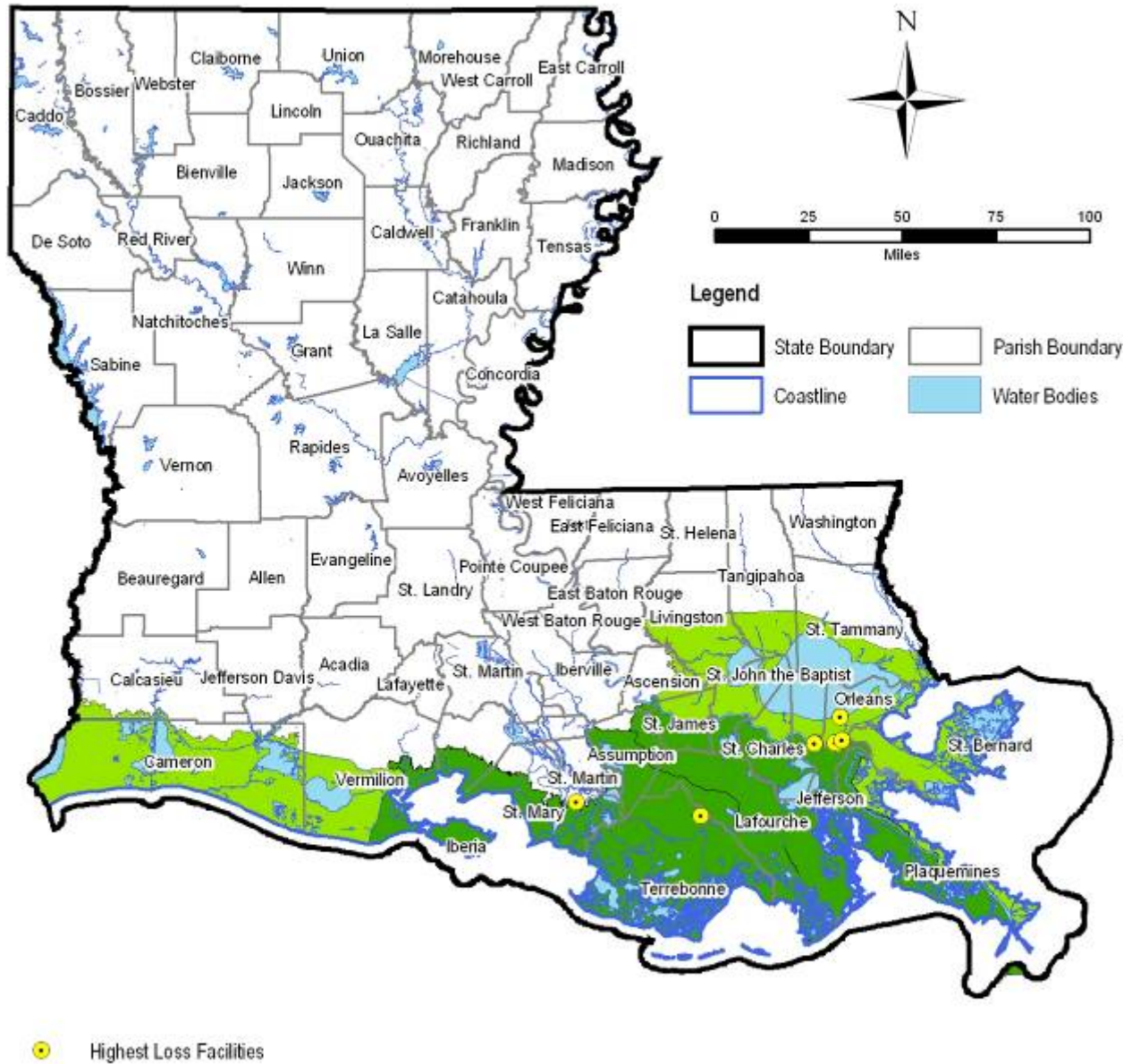
Source: USGS National Wetlands Research Center



Map F-90: Loss Estimate - Subsidence (Land Loss) - Top 10 - Department of Health and Hospitals



**Map F-91: Loss Estimate - Subsidence (Land Loss) - Top 10 - Department of Transportation and Development**



Source: Louisiana Facility Management Database

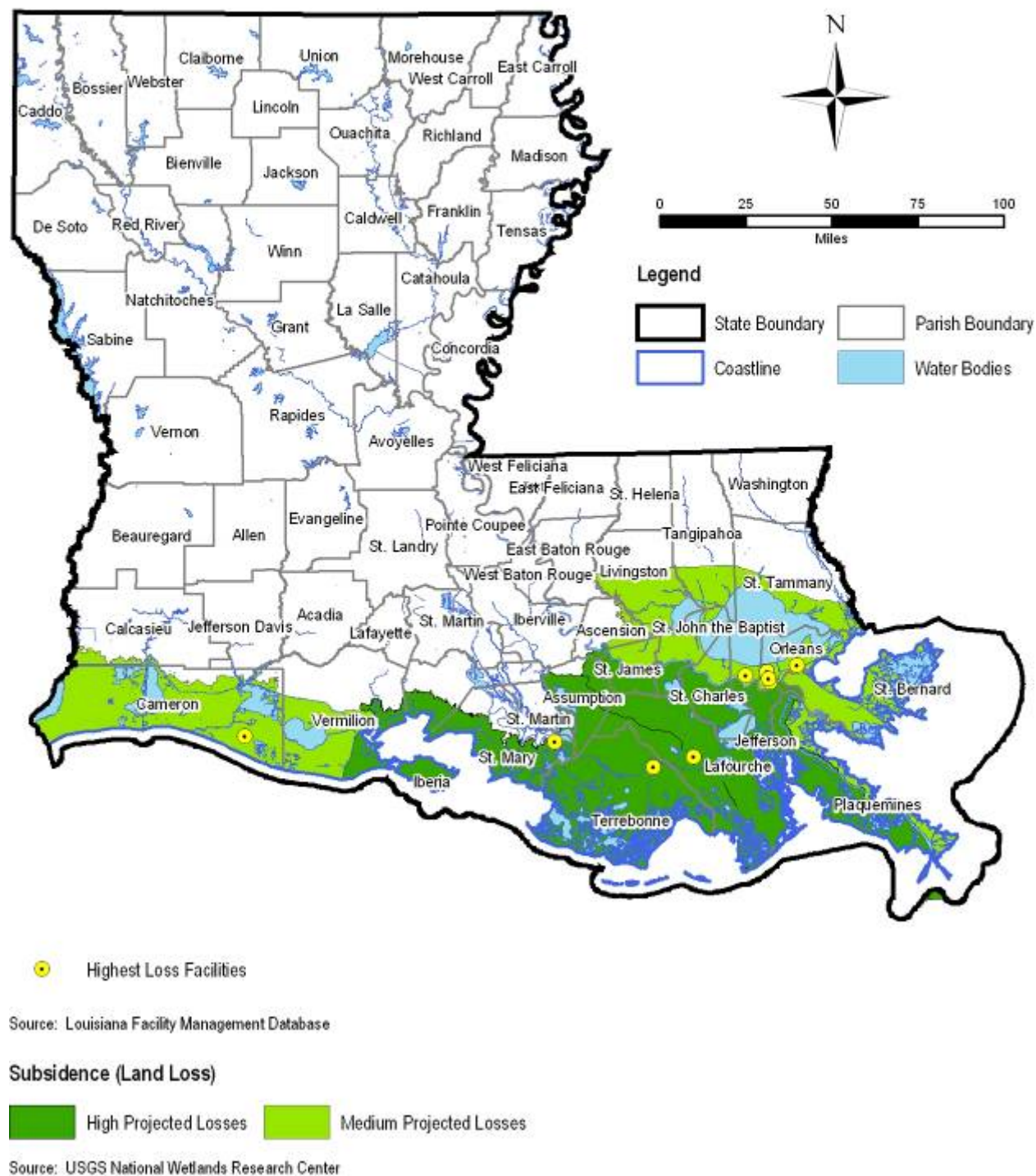
**Subsidence (Land Loss)**

High Projected Losses Medium Projected Losses

Source: USGS National Wetlands Research Center

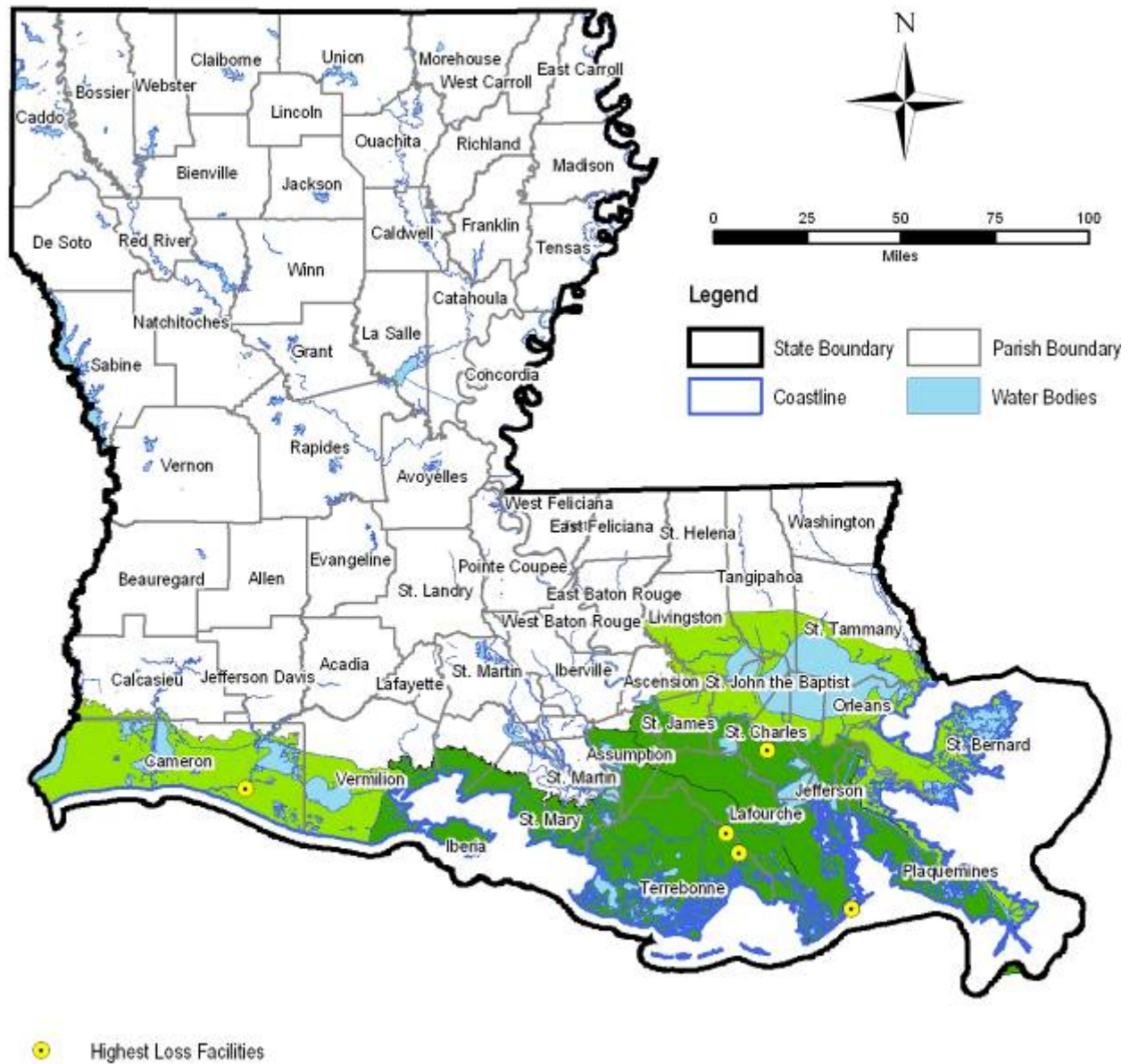


Map F-92: Loss Estimate - Subsidence (Land Loss) - Top 10 - Unknown Departments





Map F-93: Loss Estimate - Subsidence (Land Loss) - Top 10 - Department of Wildlife and Fisheries



Source: Louisiana Facility Management Database

**Subsidence (Land Loss)**

High Projected Losses Medium Projected Losses

Source: USGS National Wetlands Research Center